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| 10/773,186 | 02/09/2004 | Kia Silverbrook | MTB25US | 8433 |
| 24011 7590 10/28/2008 SILVERBROOK RESEARCH PTY LTD 393 DARLING STREET BALMAIN, 2041 AUSTRALIA | | | | |
| EXAMINER | | | | |
| FIDLER, SHELBY LEE | | | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/773,186

Applicant(s)

SILVERBROOK, KIA

Examiner

SHELBY FIDLER

Art Unit

2861

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 August 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 5, 6, 8, 10-14, 16-19, 24, 25, 27, 29-33, 35-38, 40, 42-44, 46-50 and 52-54 is/are rejected.
- 7) ☒ Claim(s) 3 and 21 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 8/10/2008
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Continuation of Disposition of Claims: Claims pending in the application are 1,3,5,6,8,10-14,16-19,21,24,25,27,29-33,35-38,40,42-44,47-50 and 52-54.

DETAILED ACTION

Responsive Office Action

This Office Action is responsive to Applicant's remarks and amendments filed 8/10/2008.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 8/10/2008 has been considered by the examiner.

Claim Objections

Claims 1, 19, and 38 are objected to for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims state that the "heater element has at least one bubble nucleation section, each bubble nucleation section having a smaller cross section than the remainder of that heater element." However, this limitation seems to contradict itself. For the sake of explanation, assume that the heater element has two bubble nucleation sections. According to this claim language, when we consider the cross section of the first bubble nucleation section, it should be smaller than each remaining part of the heater element. However, the remainder of the heater element also includes the second bubble nucleation section, which (according to the currently amended claim) should also have a cross section that is smaller than each remaining part of the heater element. Therefore,

it seems impossible for "each bubble nucleation section" to be smaller than "the remainder of the heater element." Please find alternate terminology to describe this feature of the invention. Also, these claims state that the printhead comprises "a bubble forming chamber corresponding to each of the nozzles respectively." This limitation seems to state that a single bubble forming chamber is utilized for all of the nozzles. However, upon review of Applicant's original disclosure, Examiner was unable to find such a teaching. Rather, it appears that Applicant's printhead comprises a plurality of bubble forming chambers, wherein each of the bubble forming chambers correspond to one of the plurality of nozzles.

Claims 8 and 27 are objected to because of the following informalities: in each of these claims, please change "a said bubble" to "said bubble." Appropriate correction is required.

Claims 8, 17, 27, and 36 are objected to because of the following informalities: in each of these claims, please change "the ejection of a said drop" to "ejection of said drop" to place the claim in proper sentence format. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 5, 11-13, 18-19, 24, 30-32, 37-38, 40, 42, 47-48, 50, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5851412) in view of Andrews et al. (US 6568792 B2).

Regarding claims 1, 19, and 38:

Kubby discloses an ink jet printhead comprising:

a plurality of nozzles (32);

a plurality of bubble forming chambers (16), each corresponding to a respective one of the nozzles (Fig. 5);

a heater element (20a) and a non-heater element (20b) disposed in each of the bubble forming chambers to overlay one another with a space therebetween (col. 5, lines 7-10 & Fig. 4), the heater element and non-heater elements being formed of the same material (col. 4, line 66 – col. 5, line 2) and each heater element being connected to corresponding electrodes (24) so as to be in thermal contact with a bubble forming liquid in the respective bubble forming chamber (Figs. 1 & 5), such that

heating each heater element with the corresponding electrodes to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 19-24); wherein,

each heater element has a bubble nucleation section (20, 22).

Kubby does not expressly disclose that the bubble nucleation sections have a smaller cross section than other sections of that heater element.

However, Andrews et al. disclose a heater elements (800) including a bubble nucleation section (712) that has a smaller cross section than other sections of the heater element (Fig. 8). Andrews et al. teach that, by utilizing heater elements of this configuration, the printhead is able to control the drop size over a range of sizes (col. 1, lines 66 – col. 2, line 7).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to modify Kubby's doped regions (20a, 20b) to have a configuration in which the bubble nucleation section has a smaller cross section than other sections of the heater element.

Regarding claims 5, 24, and 42:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, and **Kubby also discloses** that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 1, lines 28-31 & Fig. 5).

Regarding claims 11, 30, and 47:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, and **Kubby also discloses** that each heater element (20a) has two opposite sides (20, 22) and is configured such that the gas bubble formed by the heater element is formed at both sides of that heater element (Fig. 1).

Regarding claims 12, 31, and 48:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, and **Kubby also discloses** that the bubble which each heater element is configured to form is collapsible and has a point of collapse (inherent to Kubby's

bubbles), and wherein each heater element is configured such that the point of collapse of the bubble formed thereby is spaced from that heater element (spaced at least via protective Ta layer shown in Fig. 4).

Regarding claims 13, 32, and 50:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, and **Kubby also discloses** that the printhead comprises a structure (10, 30) incorporating the nozzles (Fig. 5).

Examiner notes the additional claim language that the structure is formed by CVD; however, the method of forming a device is not germane to the patentability of the device itself, or to the patentability of a method of using the device. Therefore, this limitation has not been granted patentable weight.

Regarding claims 18, 37, and 54:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, and **Kubby also discloses** that each heater element (20a) is covered by a conformal protective coating (protective Ta layer), the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (col. 4, lines 60-63 & Fig. 4).

Regarding claim 40:

Kubby as modified by Andrews et al. disclose all the limitations of claim 38, but this combination does not expressly disclose that each bubble forming chamber has a circular cross section, and each heater element has arcuate sections that are concentric with the circular cross section.

However, this structural limitation does not seem to alter the claimed method in any manipulative sense. Therefore, this limitation has not been given patentable weight.

Claims 14, 33, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby as modified by Andrews et al., as applied to claims 1, 19, and 38 above, and further in view of Hirsh et al. (US 6406607 B1).

Regarding claims 14, 33, and 49:

Kubby as modified by Andrews et al. disclose all the limitations of claims 1, 19, and 38, **but this combination does not expressly disclose** a structure that is less than 10 microns thick and which incorporates the nozzles.

However, Hirsh et al. discloses an ink jet printhead comprising a structure (non-wetting layer 90) that is less than 10 microns thick (col. 7, lines 12-17) and which incorporates nozzles (Fig. 1). Hirsh et al. teach that, by utilizing such a layer, the printhead is able to resist liquid ink accumulation (col. 5, lines 54-59).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a non-wetting layer, such as disclosed by Hirsh et al., onto the printhead of Kubby as modified by Andrews et al.

Claims 1, 16, 19, 35, 38, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo et al. (US 6595626 B2) in view of Kawai et al. (US 6290335 B1).

Regarding claims 1, 19, and 38:

Kudo et al. disclose an inkjet printhead comprising:

a plurality of nozzles (18);

a plurality of bubble forming chambers (14+16), each corresponding to a respective one of the nozzles (Figs. 8-9);

a heater element (2) and a non-heater element (31) disposed in each of the bubble forming chambers respectively to overlay one another with a space therebetween (col. 8, lines 42-45 & Fig. 9), each heater element being connected to corresponding electrodes (5) so as to be in thermal contact with a bubble forming liquid in the respective bubble forming chamber (Fig. 9), such that,

heating each heater element with the corresponding electrodes to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 8, line 58 – col. 9, line 4 & Fig. 2); wherein,

the at least one heater element has a bubble nucleation section (as shown in Fig. 4).

Kudo et al. do not expressly disclose that the bubble nucleation section has a smaller cross section than the remainder of the heater element.

However, Kawai et al. disclose a heater element (102 + 103) comprising a bubble nucleation section (102) that has a smaller cross section than the remainder of the heater element (Fig. 6). Kawai et al. teach that, by utilizing such a heater element, the inkjet printhead is capable of achieving very fine recording (col. 2, lines 39-47).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the heater elements disclosed by Kawai et al., in the printhead of Kudo et al.

Regarding claims 16, 35, and 52:

Kudo et al. as modified by Kawai et al. disclose all the limitations of claims 1, 19, and 38, and **Kudo et al. also disclose** that each heater element (2) is formed of solid material (TaN) more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50 (col. 20, lines 5-12).

Claims 8, 17, 27, 36, 44, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo et al. as modified by Kawai et al., as applied to claims 1, 19, and 38 above, and further in view of Murthy et al. (US 6120135).

Regarding claims 8, 27, and 44:

Kudo et al. as modified by Kawai et al. disclose all the limitations of claims 1, 19, and 38, **but this combination does not expressly disclose** that each heater element is configured such that an actuation energy of less than 500 nJ is required to be applied to that heater element to heat that heater element sufficiently to form the bubble in the bubble forming liquid thereby to cause ejection of the drop.

However, Murthy et al. disclose printhead circuitry (Fig. 2) that allows a heating element (12) to achieve drop ejection with less than 500 nJ (col. 11, lines 55-64). Murthy et al. disclose that, by utilizing such printhead circuitry, the amount of energy required to effect bubble formation is reduced (col. 11, lines 36-41).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the printhead circuitry design disclosed by Murthy et al. into Kudo et al.'s modified printhead.

Regarding claims 17, 36, and 53:

Kudo et al. as modified by Kawai et al. disclose all the limitations of claims 1, 19, and 38, and **Kudo et al. also disclose** that each heater element (2) includes solid material (col. 20, lines 5-12) and is to be heated to a temperature above the boiling point thereby to heat the bubble forming liquid to a temperature above the boiling point to cause ejection of the drop (col. 20, lines 12-14 & Fig. 4).

This combination does not expressly disclose that the heater element is less than 10 nanograms.

However, Murthy et al. disclose a heater element that is less than 10 nanograms (using the known approximate thin film TaO density of 3.8 g/cm^3 , and given the heater element dimensions disclosed in col. 11, lines 55-64, the total mass of the heater element is 1.2 nanograms).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize the heater element of Murthy et al. in place of that disclosed by Kudo et al., since both heater elements are disclosed as functioning to eject droplets of ink, and since a person of ordinary skill would have a high expectation of successful ink drop ejection by utilizing Murthy et al.'s heater element.

Claims 6, 10, 25, 29, 43, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Kubby, as applied to claims 1, 19, 38 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Kudo et al. as modified by Kawai et al. discloses all the limitations of claims 1, 19, and 38, but **this combination does not expressly disclose** that the printhead is a page-width printhead.

However, Silverbrook discloses that, by utilizing a pagewidth printhead (head 200), a printer is able to print on the width of an A4 page (col. 6, lines 7-12).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to make the ink jet printhead of Kudo et al. as modified by Kawai et al. to be a pagewidth printhead, such as disclosed by Silverbrook.

Regarding claims 10, 29, and 46:

Kudo et al. as modified by Kawai et al. discloses all the limitations of claims 1, 19, and 38, and **Kudo et al. also disclose** that the printhead comprises a substrate (50 - Fig. 8).

This combination does not expressly disclose that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and

counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter:

$$\frac{20\text{nozzles}}{0.0016384\text{cm}^2} = 12207 \frac{\text{nozzles}}{\text{cm}^2}).$$
 Silverbrook teaches that, by utilizing such a nozzle

density, the printer can provide four nozzles per pixel, which can provide up to 16 drops per nozzle (col. 16, lines 60-62).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface having a nozzle density of 10,000 nozzles per square centimeter, such as disclosed by Silverbrook, into the printhead of Kudo et al. as modified by Kawai et al.

Allowable Subject Matter

Claims 3 and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 3 and 21 contains allowable subject matter since the prior art of record does not disclose, teach, or make obvious an ink jet printhead comprising a heater element that has arcuate sections that are concentric with the circular cross section. It is this limitation, in combination with other features and limitations of claims 1 and 18, respectively, that makes these claims allowable over the prior art of record.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHELBY FIDLER whose telephone number is (571)272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/LUU MATTHEW/
Supervisory Patent Examiner, Art Unit 2861

/Shelby Fidler/
Examiner, Art Unit 2861